E 1.28: SOLAR / 1039-79/05 Aleph 1215971

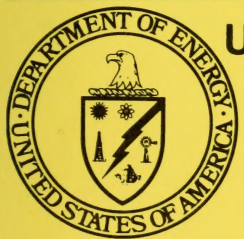
SOLAR/1039-79/05

Monthly Performance Report

SADDLE HILL TRUST

LOT 73

MAY 1979



U.S. Department of Energy

National Solar Heating and Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT

SADDLE HILL TRUST
LOT 73

MAY 1979

I. SYSTEM DESCRIPTION

Saddle Hill Trust Lot 73 is a single-family residence in Medway, Massachusetts. Solar energy is used for preheating incoming city water. The system has an array of flat-plate collectors with a gross area of 45 square feet. The array faces south at an angle of 45 degrees to the horizontal. A 60 percent glycerol solution is used as the medium for delivering solar energy from the collector array to storage. Water is the transport medium that delivers solar energy to storage and to the domestic-hot-water (DHW) heater. Solar energy is stored in the basement in an 80-gallon preheat tank. This preheated city water is supplied, on demand, to a conventional 40-gallon DHW tank. When solar energy is insufficient to satisfy the hot water requirements, the gas-driven DHW heater provides auxiliary energy for water heating. The system, shown schematically in Figure 1, has two modes of solar operation.

Mode 1 - Collector-to-Storage: This mode activates when a 40°F temperature difference exists between the collector and the preheat tank. Pump P1 is on. This mode continues operating until the temperature difference drops to 20°F.

Mode 2 - Storage-to-DHW Tank: This mode activates when there is a demand for hot water. Hot water from the top of the preheat tank is transferred to the DHW tank to replace the amount removed. Simultaneously, city water is automatically supplied to the preheat tank.

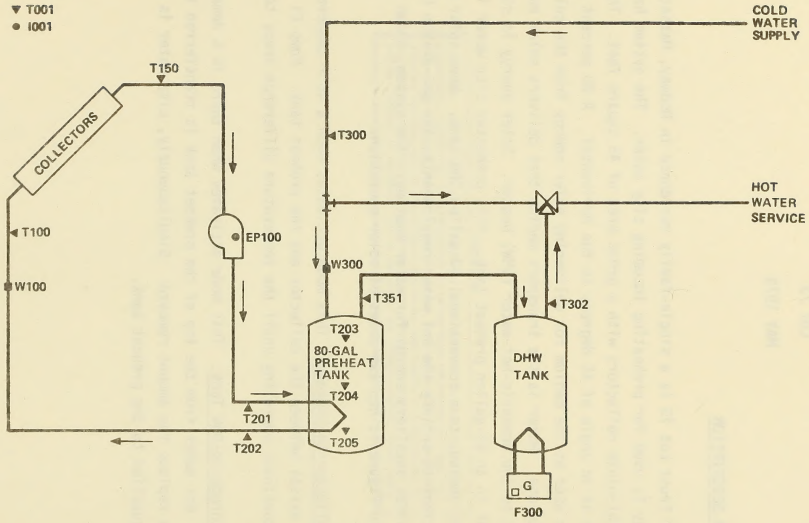

Figure 1. SADDLE HILL TRUST, LOT NO. 73 SOLAR ENERGY SYSTEM SCHEMATIC

II. PERFORMANCE EVALUATION

INTRODUCTION

The site was occupied in May and the solar energy system operated continuously during the month. Total solar energy collected was 1.1 million Btu and the total solar energy used was 0.68 million Btu or 62 percent of the collected energy. The change in stored energy was 0.01 million Btu, while the loss from storage amounted to 0.29 million Btu. Solar energy satisfied 57 percent of the DHW requirements. The solar energy system provided fossil fuel savings of 1.1 million Btu and incurred an electrical expense of 0.17 million Btu.

WEATHER CONDITIONS

During the month, total incident solar energy on the collector array was 1.8 million Btu for a daily average of 1292 Btu per square foot. This was below the estimated average daily solar radiation for this geographical area during May of 1433 Btu per square foot for a south-facing plane with a tilt of 45 degrees to the horizontal. The average ambient temperature during May was 61°F as compared with the long-term average for May of 59°F.

THERMAL PERFORMANCE

System - During May the solar energy system performed approximately the same as expected. The expected performance was determined from a modified f-chart analysis using measured weather and subsystem loads as input. Solar energy used by the system was estimated by assuming that all energy collected would be applied to the load. Actual solar energy used was 0.68 million Btu versus an estimated 0.76 million Btu. System total solar fraction was 57 percent versus an estimated 64 percent.

Collector - The total incident solar radiation on the collector array for the month of May was 1.8 million Btu. During the period the collector loop was operating, the total insolation amounted to 1.6 million Btu. The total collected solar energy for the month of May was 1.1 million Btu, resulting in a collector array efficiency of 59 percent, based on total incident insolation. Solar energy delivered from the collector array to storage was 0.98 million Btu. Energy loss during transfer from the collector array to storage was 0.12 million Btu. This loss represented 11 percent of the energy collected. Operating energy required by the collector loop was 0.17 million Btu.

Storage - Solar energy delivered to storage was 0.98 million Btu. There were 0.68 million Btu delivered from storage to the DHW subsystem. Energy loss from storage was 0.29 million Btu. This loss represented 29 percent of the energy delivered to storage. The storage efficiency was 71 percent: This is calculated as the ratio of the sum of the energy removed from storage and the change in stored energy, to the energy delivered to storage. The average storage temperature for the month was 91°F.

DHW Load - The DHW subsystem consumed 0.68 million Btu of solar energy and 0.86 million Btu of auxiliary fossil fuel energy to satisfy a hot water load of 1.1 million Btu. The solar fraction of this load was 57 percent. Losses from the DHW subsystem were 0.098 million Btu. A daily average of 59 gallons of DHW was consumed at an average temperature of 128°F delivered from the tank.

OBSERVATIONS

There are no significant observations to report.

ENERGY SAVINGS

The solar energy system provided a fossil fuel energy savings of 1.1 million Btu, while incurring an electrical energy expense of 0.17 million Btu.

III. ACTION STATUS

There are no significant items to report.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 02053 SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

SITE/SYSTEM DESCRIPTION:
THE SADDLE HILL TRUST, LOT #73 SOLAR ENERGY SYSTEM FURNISHES HOT WATER YEAR-ROUND TO A SINGLE FAMILY DWELLING. THE COLLECTOR IS A TWO-PANEL LIQUID COLLECTOR. STORAGE SPACE IS AN 80 GALLON WATER TANK. AUXILIARY HOT WATER IS PROVIDED BY A GAS HOT WATER HEATER.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	1.802	MILLION BTU
	40038	BTU/SQ.FT.
COLLECTED SOLAR ENERGY	1.065	MILLION BTU
	23661	BTU/SQ.FT.
AVERAGE AMBIENT TEMPERATURE	61	DEGREES F
AVERAGE BUILDING TEMPERATURE	N.A.	DEGREES F
ECSS SOLAR CONVERSION EFFICIENCY	0.38	
ECSS OPERATING ENERGY	0.170	MILLION BTU
TOTAL SYSTEM OPERATING ENERGY	0.170	MILLION BTU
TOTAL ENERGY CONSUMED	2.092	MILLION BTU

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	1.097	N.A.	N.A.	1.097 MILLION BTU
SOLAR FRACTION	57	N.A.	N.A.	57 PERCENT
SOLAR ENERGY USED	0.681	N.A.	N.A.	0.681 MILLION BTU
OPERATING ENERGY	N.A.	N.A.	N.A.	0.170 MILLION BTU
AUX. THERMAL ENERGY	0.514	N.A.	N.A.	0.514 MILLION BTU
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. MILLION BTU
AUX. FOSSIL FUEL	0.857	N.A.	N.A.	0.857 MILLION BTU
ELECTRICAL SAVINGS	N.A.	N.A.	N.A.	-0.170 MILLION BTU
FOSSIL SAVINGS	1.136	N.A.	N.A.	1.136 MILLION BTU

SYSTEM PERFORMANCE FACTOR: 0.771

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM,FEBRUARY 28,1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
SITE SUMMARY

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 02053 SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

SITE/SYSTEM DESCRIPTION:
THE SADDLE HILL TRUST, LOT #73 SOLAR ENERGY SYSTEM FURNISHES HOT WATER YEAR-ROUND TO A SINGLE FAMILY DWELLING. THE COLLECTOR IS A TWO-PANEL LIQUID COLLECTOR. STORAGE SPACE IS AN 80 GALLON WATER TANK. AUXILIARY HOT WATER IS PROVIDED BY A GAS HOT WATER HEATER.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY	1.901 GIGA JOULES
	454669 KJ/SQ.M.
COLLECTED SOLAR ENERGY	1.123 GIGA JOULES
	268694 KJ/SQ.M.
AVERAGE AMBIENT TEMPERATURE	16 DEGREES C
AVERAGE BUILDING TEMPERATURE	N.A. DEGREES C
ECSS SOLAR CONVERSION EFFICIENCY	0.38
ECSS OPERATING ENERGY	0.179 GIGA JOULES
TOTAL SYSTEM OPERATING ENERGY	0.179 GIGA JOULES
TOTAL ENERGY CONSUMED	2.207 GIGA JOULES

SUBSYSTEM SUMMARY:

	HOT WATER	HEATING	COOLING	SYSTEM TOTAL
LOAD	1.157	N.A.	N.A.	1.157 GIGA JOULES
SOLAR FRACTION	57	N.A.	N.A.	57 PERCENT
SOLAR ENERGY USED	0.719	N.A.	N.A.	0.719 GIGA JOULES
OPERATING ENERGY	N.A.	N.A.	N.A.	0.179 GIGA JOULES
AUX. THERMAL ENG	0.543	N.A.	N.A.	0.543 GIGA JOULES
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.	N.A. GIGA JOULES
AUX. FOSSIL FUEL	0.904	N.A.	N.A.	0.904 GIGA JOULES
ELECTRICAL SAVINGS	N.A.	N.A.	N.A.	-0.179 GIGA JOULES
FOSSIL SAVINGS	1.198	N.A.	N.A.	1.198 GIGA JOULES

SYSTEM PERFORMANCE FACTOR: 0.771

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978, SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 02053 SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.086	58	0.021	N	0.007	N	0.249
2	0.105	54	0.030	C	0.006	C	0.286
3	0.074	56	0.035	T	0.005	T	0.470
4	0.074	65	0.031		0.007		0.414
5	0.106	57	0.037	A	0.007	A	0.352
6	0.083	56	0.026	P	0.005	P	0.319
7	0.099	62	0.023	P	0.006	P	0.236
8	0.095	65	0.047	L	0.007	L	0.495
9	0.089	81	0.031	I	0.007	I	0.349
10	0.086	85	0.045	C	0.007	C	0.525
11	0.093	64	0.037	A	0.007	A	0.397
12	0.034	60	0.019	B	0.007	B	0.544
13	0.020	63	0.006	L	0.004	L	0.292
14	0.014	62	0.015	E	0.005	E	1.076
15	0.014	61	0.008		0.005		0.556
16	0.066	66	0.021		0.007		0.315
17	0.073	57	0.018		0.007		0.241
18	0.034	55	0.024		0.005		0.716
19	0.019	52	0.011		0.005		0.580
20	0.019	54	0.008		0.005		0.392
21	0.043	61	0.007		0.006		0.160
22	0.097	68	0.029		0.007		0.300
23	0.021	55	0.018		0.004		0.856
24	0.008	52	0.014		0.000		1.731
25	0.017	56	0.003		0.005		0.177
26	0.037	55	0.012		0.005		0.321
27	0.082	63	0.025		0.007		0.303
28	0.016	59	0.013		0.003		0.830
29	0.081	67	0.011		0.006		0.133
30	0.016	57	0.024		0.003		1.466
31	0.099	68	0.033		0.007		0.338
SUM	1.802	-	0.681	N.A.	0.170	N.A.	-
AVG	0.058	61	0.022	N.A.	0.005	N.A.	0.378
NBS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
COLLECTOR ARRAY PERFORMANCE

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 0205SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.086	0.082	0.057	72	0.661
2	0.105	0.099	0.062	69	0.591
3	0.074	0.066	0.045	70	0.609
4	0.074	0.071	0.048	80	0.656
5	0.106	0.103	0.065	66	0.614
6	0.083	0.076	0.051	70	0.619
7	0.099	0.092	0.057	75	0.568
8	0.095	0.090	0.059	79	0.622
9	0.089	0.085	0.057	96	0.642
10	0.086	0.082	0.055	99	0.637
11	0.093	0.089	0.057	70	0.616
12	0.034	0.031	0.018	67	0.531
13	0.020	0.014	0.007	67	0.324
14	0.014	0.010	0.005	65	0.379
15	0.014	0.011	0.006	63	0.425
16	0.066	0.062	0.043	79	0.654
17	0.073	0.068	0.042	66	0.567
18	0.034	0.030	0.019	57	0.552
19	0.019	0.015	0.008	54	0.402
20	0.019	0.014	0.008	56	0.410
21	0.043	0.039	0.026	65	0.602
22	0.097	0.092	0.059	81	0.609
23	0.021	0.015	0.008	63	0.401
24	0.008	0.000	0.000	52	0.000
25	0.017	0.014	0.009	59	0.513
26	0.037	0.032	0.020	57	0.546
27	0.082	0.077	0.047	74	0.572
28	0.016	0.009	0.005	60	0.347
29	0.081	0.074	0.051	80	0.630
30	0.016	0.011	0.006	60	0.387
31	0.099	0.095	0.064	84	0.642
SUM	1.802	1.648	1.065	-	-
AVG	0.058	0.053	0.034	70	0.591
NBSID	Q001		Q100		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
STORAGE PERFORMANCE

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 0205SOLAR/1039-79/05
REPORT PERIOD: MAY, 1979

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORED ENERGY MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.052	0.021	0.019	87	0.782
2	0.055	0.030	0.006	111	0.663
3	0.041	0.035	-0.010	102	0.614
4	0.046	0.031	0.004	93	0.746
5	0.061	0.037	0.008	105	0.745
6	0.046	0.026	0.002	105	0.607
7	0.050	0.023	0.009	123	0.660
8	0.054	0.047	-0.016	117	0.582
9	0.052	0.031	0.006	113	0.705
10	0.051	0.045	-0.011	112	0.667
11	0.053	0.037	-0.001	104	0.682
12	0.017	0.019	-0.006	89	0.742
13	0.007	0.006	-0.002	86	0.506
14	0.005	0.015	-0.009	73	1.204
15	0.007	0.008	0.000	68	1.210
16	0.042	0.021	0.012	81	0.771
17	0.039	0.018	0.011	96	0.724
18	0.018	0.024	-0.014	85	0.600
19	0.006	0.011	-0.005	75	0.952
20	0.006	0.008	-0.001	73	0.965
21	0.025	0.007	0.014	79	0.830
22	0.055	0.029	0.007	105	0.667
23	0.007	0.018	-0.014	89	0.553
24	0.000	0.014	-0.014	69	1.000
25	0.007	0.003	0.006	66	1.213
26	0.019	0.012	0.003	74	0.788
27	0.043	0.025	0.004	94	0.672
28	0.005	0.013	-0.007	74	1.219
29	0.047	0.011	0.023	94	0.716
30	0.005	0.024	-0.022	87	0.310
31	0.060	0.033	0.011	90	0.735
SUM	0.981	0.681	0.012	-	-
AVG	0.032	0.022	0.000	91	0.707
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
HOT WATER SUBSYSTEM

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 02053 SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR.OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.041	45	0.021	N	0.020	N	0.033	N	0.036	53	129	63
2	0.034	57	0.030	O	0.015	O	0.024	O	0.050	54	125	54
3	0.035	85	0.035	T	0.000	T	0.000	T	0.058	57	120	63
4	0.047	70	0.031		0.019		0.032		0.051	56	124	78
5	0.052	65	0.037	A	0.018	A	0.031	A	0.062	57	126	83
6	0.027	85	0.026	P	0.007	P	0.011	P	0.044	59	118	51
7	0.023	77	0.023	P	0.000	P	0.000	P	0.039	59	120	41
8	0.044	93	0.047	L	0.000	L	0.000	L	0.079	59	125	73
9	0.030	98	0.031	I	0.000	I	0.000	I	0.052	63	124	52
10	0.044	99	0.045	C	0.000	C	0.000	C	0.075	62	125	75
11	0.042	92	0.037	A	0.005	A	0.009	A	0.061	58	128	71
12	0.025	85	0.019	B	0.010	B	0.017	B	0.031	61	125	44
13	0.012	64	0.006	L	0.008	L	0.014	L	0.010	59	125	23
14	0.047	44	0.015	E	0.034	E	0.057	E	0.025	60	135	74
15	0.040	27	0.008		0.037		0.061		0.013	61	141	64
16	0.050	28	0.021		0.032		0.053		0.034	60	137	80
17	0.028	49	0.018		0.008		0.014		0.029	58	127	49
18	0.043	56	0.024		0.027		0.045		0.040	60	127	74
19	0.033	36	0.011		0.029		0.048		0.018	65	131	55
20	0.031	26	0.008		0.029		0.049		0.013	64	132	48
21	0.028	23	0.007		0.021		0.036		0.011	61	132	45
22	0.040	42	0.029		0.016		0.026		0.049	62	128	67
23	0.019	74	0.018		0.000		0.000		0.030	60	124	34
24	0.050	42	0.014		0.045		0.076		0.023	59	131	79
25	0.027	18	0.003		0.030		0.050		0.005	61	132	44
26	0.039	21	0.012		0.033		0.055		0.020	59	130	65
27	0.026	55	0.025		0.000		0.000		0.042	61	127	49
28	0.028	56	0.013		0.022		0.037		0.022	62	129	48
29	0.025	38	0.011		0.016		0.026		0.018	62	133	42
30	0.037	58	0.024		0.016		0.027		0.040	60	127	66
31	0.048	58	0.033		0.017		0.028		0.056	60	130	83
SUM	1.097	-	0.681	N.A.	0.514	N.A.	0.857	N.A.	1.136	-	-	1835
AVG	0.035	57	0.022	N.A.	0.017	N.A.	0.028	N.A.	0.037	60	128	59
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT
ENVIRONMENTAL SUMMARY

SITE: SADDLE HILLS TRUST LOT #73 , MEDWAY, MA 02053 SOLAR/1039-79/05
REPORT PERIOD: MAY,1979

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	DAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1917	NOT APPLICABLE	58	72	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2	2330		54	69			
3	1642		56	70			
4	1640		65	80			
5	2366		57	66			
6	1843		56	70			
7	2210		62	75			
8	2117		65	79			
9	1975		81	96			
10	1908		85	99			
11	2066		64	70			
12	763		60	67			
13	449		63	67			
14	310		62	65			
15	313		61	63			
16	1462		66	79			
17	1627		57	66			
18	752		55	57			
19	422		52	54			
20	427		54	56			
21	956		61	65			
22	2161		68	81			
23	460		55	63			
24	174		52	52			
25	385		56	59			
26	824		55	57			
27	1828		63	74			
28	352		59	60			
29	1794		67	80			
30	363		57	60			
31	2202		68	84			
SUM	40038	N.A.	-	-	-	-	-
AVG	1292	N.A.	61	70	N.A.	N.A.	N.A.
NBS ID	Q001		N113			N115	N114

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

UNIVERSITY OF FLORIDA
3 1262 09052 6095